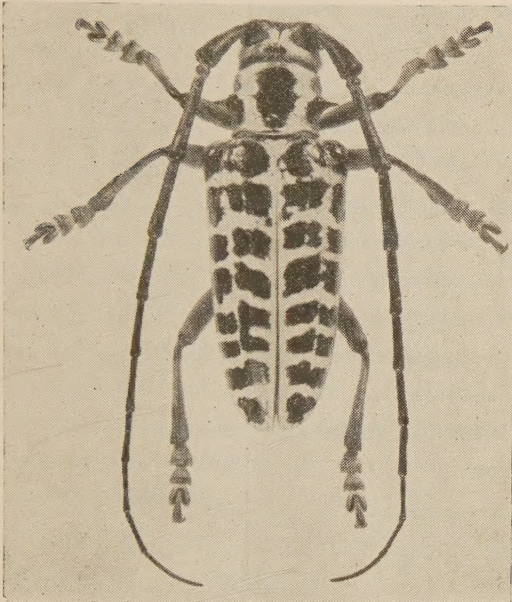


Control of Shade Tree Borers

F. A. Fenton



Cottonwood Borer Beetle

AGRICULTURAL EXPERIMENT STATION
OKLAHOMA AGRICULTURAL AND MECHANICAL COLLEGE
STILLWATER

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INTRODUCTION

This circular discusses the biologies and control of 15 of the more common and injurious species of wood-boring insects in Oklahoma. Tree borers are serious enemies of shade trees. Very often their work is overlooked until the tree becomes unthrifty and shows thinning foliage, dead limbs and dead areas in the bark. Such a condition may be the result of a fungous disease, drouth, or poor soil; but boring insects may follow or accompany such troubles. As a rule, the presence of borers is indicated by little piles of sawdust, castings or wood cuttings at the base of the tree or in crevices in the bark, by holes through which the borers have emerged, and by gummy exudations or dead areas in the bark. Many borers prefer to attack unthrifty trees and will eventually kill them. Some species, however, will infest healthy, well cared for trees; and there are some that will not attack a tree until it is already dying due to other causes.

In order to make this circular more usable, a host index is given on pages 27 and 28. In this index the various species of borers are listed under the common names of the trees they are known to infest, with the page number indicating where the insects are discussed. For example, if a poplar tree is found to be infested with borers, a glance at the index will reveal that one or more of three species may be causing the injury, namely the carpenter worm, the cottonwood borer or the poplar borer. By turning to the pages where these species are described, it will be possible in most cases to determine which of the three is present and what control measures to undertake.

GENERAL RECOMMENDATIONS FOR BORER CONTROL

WORMING

The oldest method of borer control is to insert a pliable wire of some sort into the opening of the tunnel and push it along the burrow as far as possible in the hope of finally reach-

The photographs used to illustrate this circular (except Fig. 16) are by G. A. Bieberdorf, assistant professor of entomology at the Oklahoma A. and M. College. The plate for Fig. 16 was loaned by the North Dakota Agricultural Experiment Station.

ing the borer and killing it. This method is very laborious and is liable to injure the tree. Moreover, many serious tree borers work in the tops of the trees and are not accessible to this treatment.

CARBON DISULPHIDE

This chemical, often known locally as "high life" or "hokey pokey," is a well known insecticide. The fumes which it gives off are offensive and are injurious to man if breathed too much in a closed space. Furthermore, the gas given off is decidedly explosive when mixed with air. Nevertheless it is fairly safe if used with caution. Locate the tunnel caused by the borer, inject a few drops, and plug up the entrance with mud or grafting wax.

POISON OIL SPRAY

Poison oil spray is effective against borers in trunks or larger limbs, where the insects are located just under the bark as in the case of overwintering locust borers. It is very important that none of this spray come in contact with vegetation or the leaves of the trees. Both arsenite of soda and arsenate of soda are soluble in water and therefore a spray containing either one, even in small amounts, will severely burn foliage. Extra-light application is recommended, especially on trees known to be susceptible to oils. The formula for this is as follows:

Arsenite of soda or arsenate of soda	1/2 pound
Water	5 gallons
Miscible oil	1 quart

Dissolve the arsenic in the water then add the miscible oil and agitate mixture thoroughly. For locust borer control apply to the bark just as the new growth appears at the tips of the twigs in the spring. Be sure to reach all places where larvae are working.

PARADICHLOROBENZENE AND COTTONSEED OIL

Hutson, of the Michigan Agricultural Experiment Station, has recommended the following formula applied in daubs over the injured area in the early spring or late fall:

Paradichlorobenzene	1 pound
Cottonseed Oil	2 quarts

Warm the cottonseed oil and stir in the paradichlorobenzene. (The latter is also sold under such trade names as "Crystal Gas," "P. D. B.," "Paradow," "Paracide," and "Dichloride.") *Paint trunk of tree only immediately over the infested*

part. This treatment kills the borers, but will not prevent re-infestation.

This preparation should not be used during excessively hot weather because it may injure the tree if used then.

PREVENTION

Many of the borers which are discussed in this circular prefer to attack devitalized trees. Therefore any method of soil fertilization, pruning, watering, etc., that will keep the tree in a healthy condition will aid in minimizing borer damage.

A complete discussion of the care of shade trees under Oklahoma conditions is given in Bulletin 234 of the Oklahoma Agricultural Experiment Station. Careful following of the instructions in this bulletin will help keep trees in a healthy condition and therefore able to resist borer attacks.

BIRD ENCOURAGEMENT

Many birds, especially those species such as woodpeckers and their allies, are natural enemies of tree-boring insects of all kinds. Birds may be encouraged by supplying water for drinking and bathing or by furnishing nest boxes and suitable food and shelter during the nesting and winter seasons. Information on the building of bird houses and attracting birds on the farm is found in Farmers' Bulletins 912 and 1456. These are for sale by the Superintendent of Documents, Washington, D. C., for 5 cents each.

THE FLAT-HEADED APPLE-TREE BORER

(Chrysobothris femorata)

The flat-headed apple-tree borer is one of the principal insect enemies of trees in Oklahoma. Despite the fact that its common name indicates it to be a pest of the apple tree, it is a very common shade tree pest in Oklahoma. The American elm is particularly subject to its attacks. It annually kills thousands of recently transplanted shade, pecan and fruit trees throughout the state. Furthermore, it attacks and may kill large, well established trees if they are suffering from lack of water or are in unfavorable situations. For instance, a tree attempting to grow in poor soil is likely to be attacked. The flat-headed apple-tree borer is an important limiting factor in getting young orchard and shade trees established.

DIAGNOSIS OF INJURY

Trees infested with the flat-headed apple-tree borer look unthrifty because of scant foliage, dead branches, and dead areas in the bark of the main trunk or larger branches. Growth is checked, and in severe cases the tree dies. Close examination of the bark, especially on the south and west sides of the trunk, will reveal infestation. Signs of infestation are: small oval holes through which the beetles have emerged; scars in which the heartwood or sapwood is showing, with, in some cases, the bark growing over part of the dead area (Fig. 1); loose bark which is easily pulled off; and, in smooth-barked trees, the irregular tunnels of the borer, which are indicated by a corresponding dead area on the outside. When the bark over the infested region is pulled away, the irregular, winding tunnels of the borers are revealed (Fig. 2). These are packed full of sawdust, and during the growing season the borers themselves will be found at work. They are white or yellowish segmented worms, more or less flattened, and having a greatly enlarged and swollen segment just in back of the head (Fig. 10). At other times of the year, these borers are

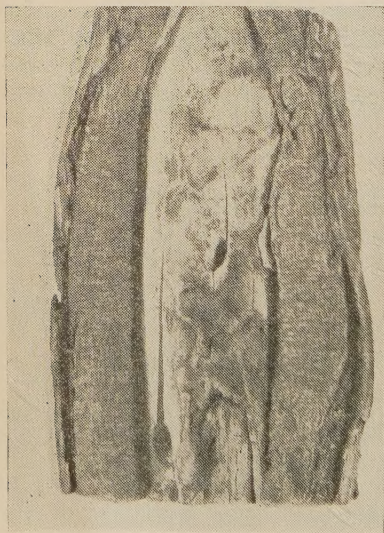


Fig. 1. Scars in tree trunk made by the flat-headed apple-tree borer. Note hole through which the beetle emerged and the bark growing over the wound.



Fig. 2. Tunnels in sapwood made by the flat-headed apple-tree borer.

found deep in the heartwood into which they have penetrated from beneath the bark (Fig. 3). At this time the small, more or less oval holes will be seen leading into the heartwood.

PAPER WRAPS PROTECT YOUNG TREES

The only effective means of protecting recently transplanted trees is to wrap them with paper. Three years experiments with 300 American elms set out along a highway showed 67 percent killed by borers when unwrapped as compared with 15 percent killed when wrapped.

A specially prepared paper for wrapping trees is manufactured by several concerns.* This paper comes in four-inch rolls, 150 feet to a roll, and is tough, resilient, and partially water-proof. Ordinary wrapping paper, cut four inches wide, may be used; but it will not last as long. Approximately two feet of paper will be needed to wrap each foot of trunk for the average-sized recently transplanted tree.

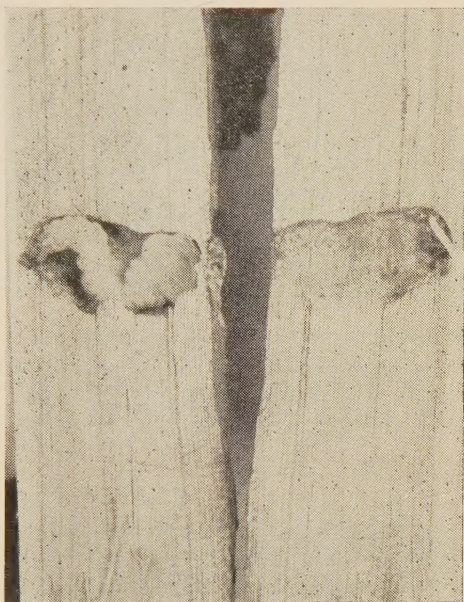


Fig. 3. Flat-headed apple-tree borer hibernating in heartwood.

There are two methods of wrapping. In the first one, begin the wrap just below ground level (Fig. 4) and continue upward in a spiral manner with a 50 percent overlap. Wrap up to the first branch. Tie at the top and bottom, loosely enough to allow for some growth. Replace soil excavated from around the base of the tree so that no part of the trunk is exposed. It is well to wrap the crotch and lower parts of the main branches (Fig. 5); otherwise the borer may girdle the tree at this point. The second method is to start the wrap at the crotch (Fig. 6) and wrap downward.

*Weissinger Paper Company, Lansing, Michigan.
Arkell Safety Bag Company, 10 East 10th Street, New York, N. Y.

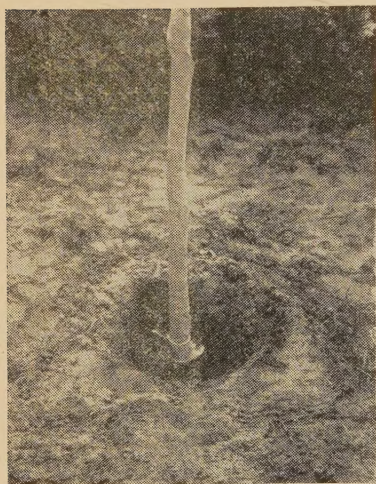


Fig. 4. Correct way of tying and wrapping base of tree for protection against the flat-headed apple-tree borer. Note loose knot and that soil has been slightly excavated around base of tree.

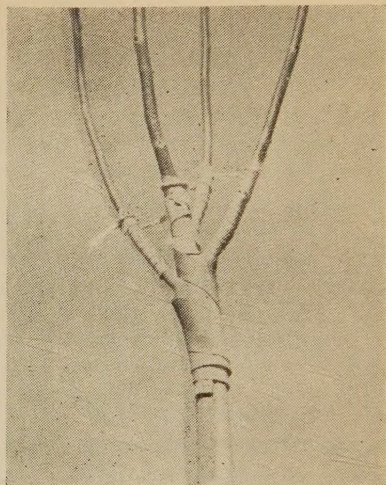


Fig. 5. Close-up of crotch of young tree, showing method of wrapping bases of larger branches. Unless this is done, the tree may be girdled at this point.

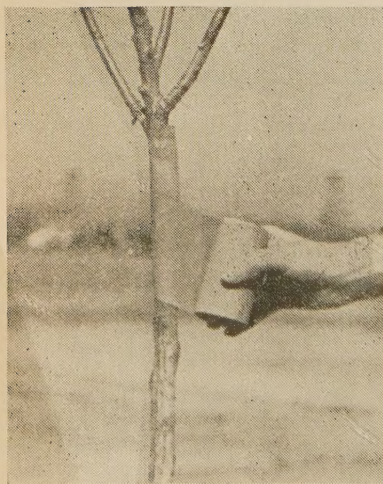


Fig. 6. Close-up of crotch of young tree, showing method of starting wrap at this point.



Fig. 7. Young tree properly wrapped for prevention of infestation by the flat-headed apple-tree borer.

So far as records at the Oklahoma Agricultural Experiment Station go, either method is satisfactory. The upward spiral sheds water in such a way that little moisture can get under the wrap. The downward spiral, on the other hand, allows some water to seep under the paper to the trunk. Fig. 7 shows a young tree properly wrapped for borer protection.

The trees should be wrapped not later than May 1 and the paper may be removed October 1. This gives the tree protection during the period when the beetles are actively flying and laying eggs.

Before wrapping the tree, cut back level with the trunk any projecting stubs so that the paper will not be punctured. Watch the wrap during the summer and repair or replace any paper torn by rubbing or other causes. It is especially necessary to replace paper at the bottom, where it is likely to rot because of wet soil or watering. Likewise, in wrapping, allow for any settling of the soil around the base which may expose part of the trunk.

The first year after transplanting is the most important from the standpoint of wrapping for flat-headed apple-tree borer control. Once the tree is well established, little protection is needed; therefore, wrapping may not be necessary the second year.

REMOVE BORERS DURING SUMMER

If borers are found at work, they may be removed with a knife. Cut away bark from the entire injured area, destroying all borers found. Treat the exposed cambium area with a shellac to prevent entrance of wood-destroying fungi. The rest of the wound should then be painted with a mixture of Bordeaux powder and linseed oil with a consistency of thick paint (Fig. 8). More complete directions for treating tree wounds are given in Oklahoma Agricultural Experiment Station Bulletin No. 234, from which this information is taken. If the wound is properly treated, the natural growth of the tree will in time cover the scar with new bark.

HEALTHY TREES RESISTANT

The flat-headed apple-tree borer attacks trees which are in a devitalized condition due to recent transplanting, drought, poor soil, gas leakage, or the attacks of other insects and fungi. Therefore, the best means of coping with this problem is prevention, by keeping the trees healthy and thrifty through spraying or other means, such as fertilizing, watering, etc., as described in the above mentioned bulletin.

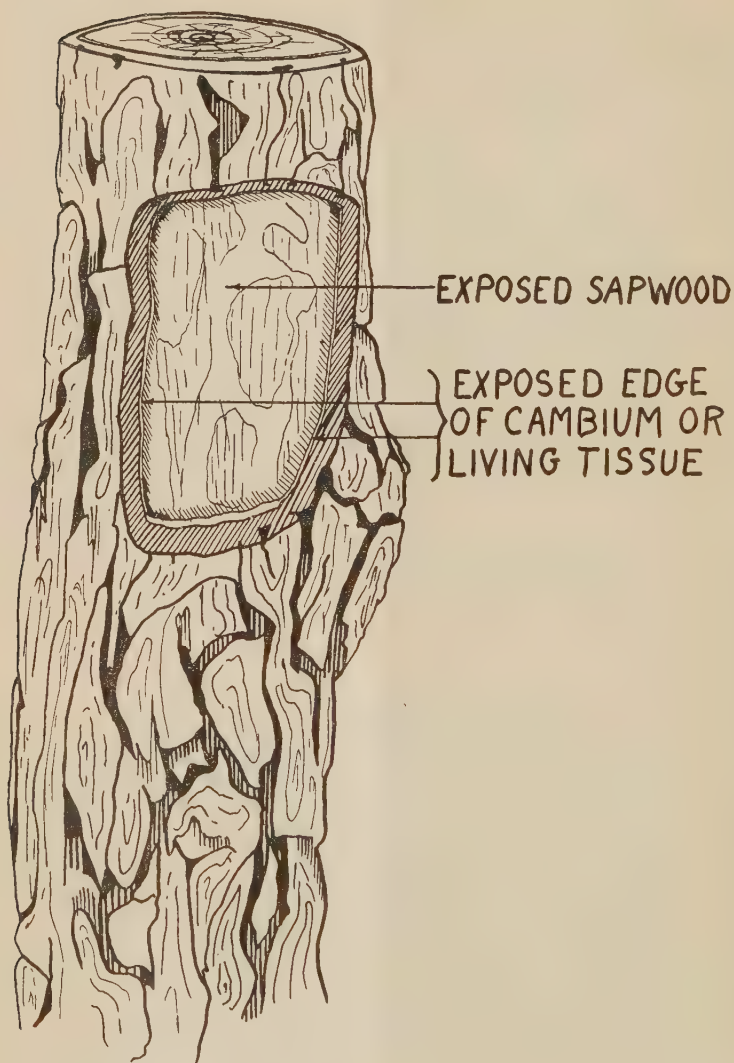


Fig. 8. Section of tree trunk showing exposed sapwood and cambium layer following bark removal to destroy flat-headed borers.

ASIATIC ELM IS RESISTANT

The Asiatic elm, more commonly known in Oklahoma as the Chinese elm, is much more resistant to the borer than the American elm. In a planting of several hundred trees of both varieties, 67 percent of the unwrapped American elms were killed in two years, as compared with 12 percent of the unwrapped Asiatic elms.

BURN DEAD WOOD BEFORE SPRING

Dead branches and trees, particularly if killed by the borers the past season, are sources of infestation because the heartwood contains many dormant borers which will pupate and emerge as beetles in the spring. Wood dead for two to three years is still dangerous, because there are always some borers which remain dormant for two seasons before completing their transformations. Trees still living but plainly devitalized because of borer attack should be pulled and burned unless it is believed the chances are good for recovery. Dead or devitalized branches on trees should be destroyed prior to May 1.

INEFFECTIVE MEASURES

Whitewashing trees will not prevent borer attack. In fact, the beetle parents of the borers are attracted by the white color, and therefore this treatment may actually increase borer infestation in the tree.

Tree paints may be highly injurious to the tree, particularly if they contain creosote. There is some evidence that certain mixtures repel a few beetles, but they do not give the tree complete protection.

Worming, which is using a fine wire to probe the galleries of the borer, is ineffective. If the hole is through the bark, the beetle has already escaped. If the bark is stripped and the hole into the heartwood made by the borer is probed, the chances are against the wire killing the insect because after reaching the heartwood it tunnels either upwards or downwards at right angles to the entrance tunnel.

LIFE CYCLE OF THE FLAT-HEADED APPLE-TREE BORER

The adult of the flat-headed apple-tree borer is a small beetle ranging from $\frac{1}{4}$ to a little over $\frac{1}{2}$ inch in length, dark bronze in color with a distinctly brassy or coppery color in some lights (Fig. 9). These beetles emerge from the trees during a period of several weeks which begins in early May and continues well into July. The beetle emerges by cutting its way

directly through the bark to the outside. These beetles are present on the trees from early May to September or later, depending upon the season.

The beetles are very active, running and dodging about the trunk and branches and flying swiftly. They feed on tender bark in crotches and around bud scars.

The eggs are laid in cracks, scars, or abrasions in the bark by the female beetle forcing her extensile ovipositor into such places. The egg, which is yellow in color, is slightly less than 1 mm. in diameter, somewhat flattened, with microscopic ridges. It hatches in about a week into a tiny borer which cuts its way out through that part of the egg which is in contact with the wood.

The larva feeds on the living tissue in and surrounding the cambium layer until it is fully developed. It is then a little over $\frac{1}{2}$ inch to about an inch long, whitish-yellow in color, with the head partly retracted into the first segment. It is somewhat flattened, and is chiefly characterized by the large swollen segment just in back of the head (Fig. 10).

When full-grown, the borer cuts deep into the sapwood and heartwood, then, turning its tunnel at right angles either upwards or downwards it forms a cell in preparation for hibernation. The first larvae start leaving the cambium region late in July, and by late September they have largely disappeared from beneath the bark. They remain in these cells in the heartwood during the winter. Some may remain dormant through two seasons, not emerging until three years after they have left the bark region. There is evidence to indicate that in some years there may be a partial second generation.

In the spring of the year the larval stage is followed by the pupal stage, without further feeding activities on the part of the borer. The pupa is somewhat less than $\frac{1}{2}$ inch long, flattened and elongate oval in shape. It is yellow or creamy yellow in color at first, then, prior to emergence of the beetle, gradually takes on a darkened coloration (Fig. 11).



Fig. 9. Two views of adult of flat-headed apple-tree borer.



Fig. 10. Flat-headed apple-tree borers.

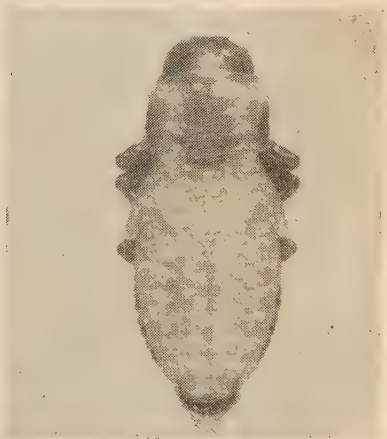


Fig. 11. Pupa of flat-headed apple-tree borer.

THE LOCUST BORER

(Cyllene robiniae)

The locust borer has been reported in the Panhandle section of Oklahoma and in the northern part of the State generally. Some reports have also been received from the southwestern part. It is very destructive to black locust. In marked contrast to the adult beetle of the flat-headed borer just discussed, the adult of the locust borer is a handsome black and golden marked beetle about $\frac{3}{4}$ inch long (Fig. 12). It is quite common in late summer and may be seen feeding upon flowers of goldenrod at that time.

The eggs are deposited in cracks in the bark of the trees. The young borers hibernate in cells in the inner bark just beneath the outer corky layer. They penetrate deeper next year (Fig. 13). The first signs of attack are brownish sawdust and wet spots, and these are followed by wet, yellowish sawdust and gummy exudations. The borers are whitish, cylindrical worms, and are full grown by midsummer at which time they are from $\frac{3}{4}$ to 1 inch long and very distinctly segmented. They pupate that summer and the beetles emerge later, the whole life cycle occupying a period of about one year.

The beetle attacks trees in thin stands or singly and will seldom attack locust trees in a thick stand. In sections where this borer is a problem, black locust should not be planted as a shade tree and when planted in wood lots the stand should be as thick as possible. In the early spring, when new growth begins to become evident at the tips of the twigs and when signs of the borers are shown by oozing sap and borings, the trees may be treated with a poison oil spray (See page 6). The borers can be killed by a treatment of paradichlorobenzene and oil early in the spring, applied with a brush over the infested area (See page 6).



Fig. 12. Adult beetle of the locust-tree borer.



Fig. 13. Galleries in black locust caused by the locust borer.

THE COTTONWOOD BORER (*Plectrodera scalator*)

The cottonwood borer is rather widely distributed in the State. It attacks cottonwood, poplar and willow trees. The larva is a large white deeply segmented grub from $1\frac{3}{4}$ to 2 inches long when full grown. These borers attack the tree mostly at the base or below ground level and may completely girdle it. The adult is a large, conspicuously colored black and white beetle about $1\frac{1}{4}$ to $1\frac{1}{2}$ inches in length (See cover). In Oklahoma these beetles are found from late May throughout August. The eggs are deposited at or a little below ground level in a hole in the bark cut by the jaws of the female; considerable injury may be done in this way to young cottonwood

and willow trees. The young borer upon hatching works in the tender bark just outside the wood, penetrating into the wood at the approach of cold weather. The second winter the much larger larvae occupy large tunnels at the base of the tree. Pupation occurs the second season, the entire life cycle extending for a two-year period.

Where the beetles are numerous, the bases of shade trees may be protected by a screen cone. This can be made from common window screening or $\frac{1}{4}$ -inch to $\frac{1}{2}$ -inch mesh screen. The top of the cone should extend about 12 inches above ground level and fit tightly around the trunk at the top. The lower part should have its lower edge sunk into the soil and should be separated from the trunk by a distance of 1 or 2 inches to prevent any eggs being laid through it in the bark. These screens should be in place from late May to September 1. Cutting out small larvae from the base and injecting carbon disulphide into the larger tunnels will eliminate most of the borers.

THE ELM BORER (*Saperda tridentata*)

The elm borer attacks white and slippery elms in a devitalized condition. English and Scotch elms are not infested. The ability of Asiatic (Chinese) elms to withstand infestation is not known. This borer is not so common in Oklahoma on elm as the flat-head. It is found chiefly in cities, where shade trees are growing under adverse conditions. It is present through most of Oklahoma.

The work of the elm borer is first shown by the thinning of the foliage and presence of dead limbs here and there, with sawdust occurring in crevices in the bark. The borer is at once distinguished from the flat-head by its more cylindrical appearance and lack of any swollen segment in back of the head,

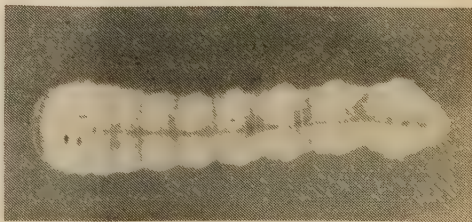


Fig. 14. Typical round-headed tree borer.

being somewhat similar in general appearance to the borer pictured in Fig. 14. The beetle is from $\frac{3}{8}$ to $\frac{1}{2}$ inch long. It is gray or fawn colored with three orange-red, transverse oblique lines across each wing cover. It is present on the trees from

late April to late July and apparently completes its life cycle in one year. Prevention by proper tree culture is the most important control. Heavily infested and weakened trees should be removed and burned before May 1.

THE POPLAR BORER

(*Saperda calcarata*)

The poplar borer infests cottonwood, poplars, and willows. It has been recorded from Payne County in the north-central part of the State to Cimarron County in the Panhandle. It is said to be a serious pest in the East, where it mars the main trunk and branches with blackened, ugly scars and honeycombs the interior of the tree with large, irregular galleries.

The beetles are found in Oklahoma from late May throughout June. They are a little over an inch long, blue-gray in color, with yellow patches and a fine stippling of black on the back. The borer is cylindrical and $1\frac{1}{4}$ inches or more in length, with the upper and lower surfaces covered with fine horny points. From two to three years are required for the completion of the life cycle. "Brood trees," which are those that are heavily attacked, should be located and cut down in early May.

THE OAK-TWIG PRUNER

(*Hypermallus villosus*)

The oak-twig pruner infests not only oaks, as the name indicates, but also hickory, pecan, maple, peach, apple, chestnut, locust, sassafras, sumac, red bud, bittersweet, pear, plum, grape, and some ornamental shrubs. The adult is a slender, grayish-brown beetle about $\frac{1}{2}$ inch in length found from March to July. It has been recorded in the northeastern part of Oklahoma. Twigs and small branches with a diameter of 1 inch or less are infested. The borer cuts off the twigs from the inside in a straight right angle cut, leaving the bark intact. It then plugs the lower part of the tunnel where it has been feeding with sawdust, etc. The twig soon breaks off and falls to the ground. In some instances, twigs imperfectly girdled will be found attached to the tree. Control consists of raking up and burning the fallen twigs.

THE HICKORY-TWIG GIRDLER

(*Oncideres texanus*)

The hickory-twig girdler (Fig. 15) is found in hickory, pecan, elm, persimmon and oak twigs. The beetles vary in color from grayish to tan and may have a distinct, ashy-gray band across the back. They are about $\frac{3}{4}$ inch long and are found from early August to late October. The female beetle girdles small branches, then lays an egg between the bark and the wood in a wound made by her jaws in the nearly severed twig. Girdled twigs usually break off with the first wind and the borer therefore develops in the fallen twig. Even a single beetle can do a tremendous amount of damage to young pecan trees by girdling all branches, Sanborn says in Oklahoma Bulletin 91. Destruction of fallen twigs by raking and burning is effective as a control measure and should be done not later than July 1, which is the date the beetles begin to emerge.



Fig. 15. Adult of the hickory twig girdler.

THE TWO-LINED CHESTNUT BORER

(*Agrilus bilineatus*)

The adult two-lined chestnut borer is a slender beetle, black in color with a more or less greenish tinge, somewhat less than $\frac{1}{2}$ inch long and having two distinct yellowish gold lines down the back. The larva is slender and of the flat-head type with a segment in back of the head distinctly wider and flatter than the segments immediately following. It is about $\frac{1}{2}$ inch long when full grown. It infests oaks in Oklahoma and usually attacks trees in a devitalized condition, but it may attack healthy trees. The black oak group appears to be somewhat more subject to infestation than the white oak group, according to Herrick's *Insect Enemies of Shade Trees*. Bur oak, scarlet oak and red oak are also infested. The borers work in

the cambium and, when numerous, may girdle the tree. Cutting out and burning all dead branches and trees before early May, when the first beetles emerge, is recommended as a preventive measure.

THE PAINTED HICKORY BORER

(*Cyllene caryae*)

As the name indicates, the painted hickory borer is mainly injurious to hickory; but it will also attack black walnut, mulberry, honey locust, osage orange, ash, wild grape, elm, hackberry, and butternut. The beetle parent of the borer, which is of the round-head type, is from $\frac{1}{2}$ to $\frac{3}{4}$ inch long, with a series of narrow, pale yellow, transverse bands on a dark brown background. One of these bands forms a distinct W-shaped mark on the wing covers just below the thorax. The beetle averages somewhat smaller than the locust borer which it closely resembles, but may be distinguished from it by the time of emergence, (from early April to May in Oklahoma). The larva varies from $\frac{1}{2}$ inch to a little over 1 inch in length. The segment near the head is broadened and flattened and the posterior segments somewhat flattened and tapering.

The painted hickory borer infests devitalized trees, those standing which are already dead, or recently cut trees which have the bark still on them. Standing dead trees and piles of unbarked timber may harbor this borer and therefore should be removed and burned or otherwise treated. Inasmuch as this borer works chiefly in unhealthy trees, attention to the best methods of tree culture will prevent infestation.

Three other borers infesting hickory in Oklahoma are: The banded hickory borer (*Chion cinctus*), generally distributed over the state; the rustic borer (*Xylotrechus colonus*), also found at least as far west as Alfalfa County; and the hickory saperda (*Saperda discoidea*), found generally in the eastern half of the state.

THE CARPENTER WORM

(Prionoxystes robiniae)

The carpenter worm has been recorded only from Payne County but is probably generally distributed at least throughout the eastern half of the state. The large, plump caterpillar is from 2 to 3 inches long, greenish-white in color, with a dark-colored head (Fig. 16f). It makes its large tunnels throughout the heartwood of oak, elm, black locust, willows, ash, box elder, poplar, cottonwood, and such fruit trees as pear and



Fig. 16. Life stages of the carpenter worm. (Courtesy of the North Dakota Agricultural Experiment Station.)



Fig. 17. Work of the carpenter worm. The pupa of one borer is seen partially projecting from its gallery.

cherry (Fig. 17). Outward signs of injury are damp, dark-colored sawdust and excrement. These signs are especially noticeable in cracks and crevices caused by shrinkage of dead bark. The dead bark may peel off, revealing the work of the younger larvae in the sapwood.

The parent of this borer is a large moth, mottled gray in color, which appears in the late spring and early summer (Fig. 16a, b). The female deposits her eggs in wounds or cracks in the bark and the young larvae work in the inner bark the first season. During the second summer they penetrate into the sapwood or heartwood. Later they work in the heartwood clear to the center of the tree. From three to four years must elapse before the carpenter worm completes its life-cycle.

Munro, in North Dakota Bulletin 278, recommends locating the entrance to the borer's tunnel and injecting a liquid fumigant by means of a medicine dropper or an oil can with a flexible spout. Carbon disulphide or a mixture of propylene dichloride and carbon tetrachloride are recommended. The best time for treatment is during the warm days in the spring. After injecting a small amount of the liquid, the hole should be sealed with putty, mud, or grafting wax, the latter being preferable. Heavily infested trees should be felled and burned in the spring before the moths emerge. The stumps of such trees should be grubbed out and burned, as they may harbor borers below the soil line.

THE PIGEON HORN-TAIL

(*Tremex columba*)

The pigeon horn-tail prefers devitalized, dying or dead trees. Since it is frequently seen near such trees, it is erroneously assumed to be the cause of the tree's unthrifty condition. The borer is a long, white, cylindrical worm often attaining a length of more than two inches with a short spine or horn on the posterior end of the body (Fig. 18). According to Houser, of the Ohio Experiment Station, this species prefers maple; but it will also attack other trees such as oak, sycamore, and elm. Large irregular burrows are cut in the wood, thus weakening the tree.

The adult is a large, wasp-like insect with 4 membranous wings about $2\frac{1}{2}$ inches across. The body is brown in color with distinct yellow markings (Fig. 19). Extending from the abdomen is a set of 3 short, thread-like appendages used in drilling holes in the wood for egg laying.

Associated with the pigeon horn-tail is a large wasp (*Thalessa lunator*) which is its natural enemy. The chief characteristic of this wasp is its long, thread-like drill. This drill is used to bore through the wood into the tunnel where

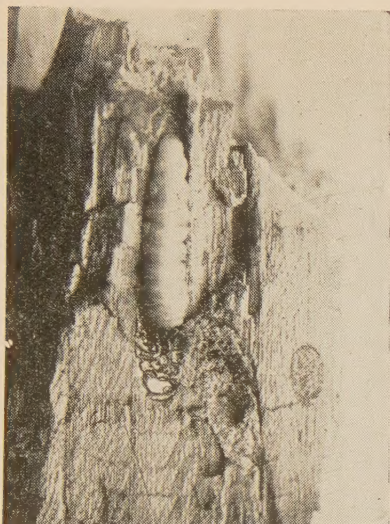


Fig. 18. Larva of the pigeon horn-tail.



Fig. 19. Adult of the pigeon horn-tail.

the horn-tail borer is working. The wasp then deposits an egg in the tunnel, and the wasp larva which hatches from this egg kills the horn-tail borer.

Since the pigeon horn-tail infests only sickly trees, prevention by methods of proper tree culture is the best remedy.

THE CARPENTER ANT (*Camponotus herculeanus*)

Occasionally shade trees are infested with large black carpenter ants. The workers vary in length from $\frac{1}{4}$ to $\frac{1}{2}$ inch and the winged forms are larger. They are jet black in color. Galleries are cut in decaying stumps, logs, house timbers, furniture, telephone poles, and living trees. The ants do not feed on wood but use it strictly as a shelter for the colony. Unless checked they may completely honeycomb the heartwood so that the tree blows over in a strong wind.

The carpenter ant may be controlled by poisoning with a mixture of 1 pound brown sugar and $\frac{1}{2}$ ounce paris green. This should be scattered thinly where the ants can get to it. Herrick, in his *Insect Enemies of Shade Trees*, also recommends injecting carbon disulphide into the cavity of the tree and then plugging the opening with some non-porous material such as damp newspapers, putty, etc.

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